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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/813,330	03/30/2004	Jong-myeong Lee	5649-1205	5124
20792	7590	09/08/2005	EXAMINER	
MYERS BIGEL SIBLEY & SAJOVEC PO BOX 37428 RALEIGH, NC 27627			EVERHART, CARIDAD	
			ART UNIT	PAPER NUMBER
			2891	

DATE MAILED: 09/08/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/813,330	LEE ET AL.	
	Examiner	Art Unit	
	Caridad M. Everhart	2891	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-20 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1-20 is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on ____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. ____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|--|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. ____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date. ____ | 6) <input type="checkbox"/> Other: ____ |

Continued Examination Under 37 CFR 1.114

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 8-26-2005 has been entered.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1,6,13, 14, and 16-18 are rejected under 35 U.S.C. 102(b) as being anticipated by Ho, et al. (US 5,354,712).

Ho, et al. disclose a mold layer 58 shown in Fig. 2a with intaglio pattern which are the damascene openings and forming a barrier 64 shown in Fig. 2a and removing the barrier from the top of the dielectric mold layer 58 as shown in Fig. 2b and filling with conductor 68 as shown in Fig. 2c. Layer 64 is TiN(col. 7, lines 62-65). Layer 68 is copper(col. 8, lines 22-25) which is used to fill the openings and which contacts the barrier layer. The dielectric 58 may be silicon oxide(col. 8, lines 28-32). Although copper is preferred, Ho, et al discloses that other metals may be used and deposited by CVD or sputtering(col. 11, lines 11-18), and aluminum was disclosed as conventionally

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used(col. 1, lines 19-24). The layer is planarized by CMP to expose the top of the intaglio layer which is the dielectric layer(col. 11, lines 15-20). Ho et al discloses the formation of a second intaglio layer on the first layer that had the filled opening(Fig. 2f) and the formation of trenches which are then lined with barrier layer and filled with conductor similarly to the first layer which had the vias formed therein(col. 8, lines 35-45).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was

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not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 2-5,7-12, 19, and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ho et al(Ho, et al. A) as applied to claim 1 above, and further in view of Teo (US 5,970,374) further in view of Ho, et al. (US 6,645,851B1)(Ho, et al B).

Ho et al is silent with respect to the formation of a sacrificial flowable layer.

Teo discloses forming an intaglio pattern in a layer¹⁴ which is an insulating layer(col. 2, lines 35-38). There is formed a barrier layer whown in Fig. 3b and is a bilayer or Ti and TiW(col. 4, lines 18-21). A flowable SOG layer 26 shown in Fig. 3B is formed in on the surface and in the opening(col. 4, lines 33-36). The upper surface of the barrier on the surface of the insulation layer is removed by CMP(col. 4, lines 49-55 and Fig. 3C). Then the opening is filled with conductor and the metal layer etched back to the insulation layer using CMP(col. 5, lines 12-16). The metal fill may be aluminum(col. 6,lines 45-49). With respect to the relative etch rates, it is known that the etch rates of SOG and of silicon oxide are different.

Ho et al B discloses that the method of forming a damascene pattern using sacrificial material may also be applied to dual damascene patterns (col. 3, lines 28-38), and dual damascene patterns have a via hole connected to a trench pattern above the via opening. The method disclosed by Ho, et al B uses a removable photoresist layer (col. 10, lines 59-62). The photoresist is etched back using developer(col. 4, lines 20-23). The photoresist may be removed using ashing(col. 4, lines 38-43). With respect to

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the relative etch rates, it is well known that the etch rates of oxide and photoresist are different.

It would have been obvious to one of ordinary skill in the art at the time of the invention to have combined the steps taught by Teo and by Ho et al B with the process taught by Ho et al A because Ho et al A teaches that the method of forming dual damascene structures is well known in the art(col. 1, lines 49-51 and Fig. 1f), and the method taught by Teo and by Ho et al B protect the barrier as the barrier on the surface of the insulation is removed which would be beneficial to the barrier in the openings.

Claim 15 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ho et al A as applied to claim 1 above, and further in view of Nishimura, et al.

Ho et al A does not teach the reflow step.

Nishimura et al discloses reflow of Al in a via will increase the quality of the filling by having no void in the opening(page 171, last paragraph). Nishimura discloses the flowing of the aluminum in a via opening(page 171, second paragraph).

It would have been obvious to one of ordinary skill in the art at the time of the invention to have flowed the Al in the damascene structure taught by Ho et al A in view of Teo and further in view of Ho et al B in order to avoid the formation of a void in the openings.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Caridad M. Everhart whose telephone number is 571-

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272-1892. The examiner can normally be reached on Monday through Fridays 7:30-4:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, B. Baumeister can be reached on 571-272-1722. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).


CARIDAD EVERHART
PRIMARY EXAMINER

C. Everhart
9-3-2005